

OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **FOREST LAKE, WINCHESTER** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *worsening* in-lake chlorophyll-a trend, meaning concentrations are increasing. Chlorophyll-a concentrations were consistent with last season's, but are still above the New Hampshire mean. There was an algae bloom in August consisting of golden-brown algae. Blue-green algae were not nearly as abundant this season, and we would like to see this trend continue. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.
- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *fairly stable* trend in lake transparency, with variable readings this summer. The clarity in August was the highest ever recorded for the lake. The extremely calm conditions helped to make the Secchi disk visible in deeper water. The high concentration of algae did not seem to affect the transparency at that time. The average clarity was just below the state mean this year. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time! These graphs show a *slightly worsening* trend for epilimnetic phosphorus levels, which means levels are increasing, and a *variable* trend for the hypolimnetic concentrations. Phosphorus concentrations in the hypolimnion improved from last season, which is a positive sign for the lake. The high result in July was due to the high turbidity of the sample. Sample contamination from bottom sediment can cause phosphorous concentrations to be elevated and yield inaccurate results. The epilimnetic average was below the state median, while the mean hypolimnetic concentration was above the state median. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Conductivity levels were low throughout the watershed this year (Table 6). Conductivity can be influenced by several means, including road runoff, agricultural runoff, and septic system failures. The increased rains this year likely helped to flush many pollutants from the state's water bodies. We would like to see this declining trend continue.
- Total phosphorus concentrations of the tributaries were also lower this summer (Table 8). Again, we can thank the rains for diluting nutrients in the waters. We will continue to observe the total phosphorus trends of the inlets and outlet.
- Dissolved oxygen was depleted from the middle to lower layers of the lake this summer (Table 9). The process of decomposition in the sediments depletes dissolved oxygen on the bottom of thermally stratified lakes. As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the mud may be released into the water column, a process that is referred to as *internal loading*. Depleted oxygen in the hypolimnion usually occurs as the summer progresses. This explains the higher phosphorus in the hypolimnion (lower water layer) versus the epilimnion (upper layer). Since an internal source of phosphorus to the lake is present, limiting or eliminating external

phosphorus sources in the lake's watershed is even more important for lake protection.

- The Exotic Species Coordinator visited the lake this summer and trained a number of volunteers to identify the common plants around the waterbody. We encourage the Forest Lake association to continue Weed Watcher activities each summer.

NOTES

- Monitor's Note (7/30/00): Flows in and out above normal. Oil sheen at inside of Dump Branch road culvert.
- Monitor's Note (8/24/00): Campground Inlet slow flow, new campsites being built.

USEFUL RESOURCES

Guidelines for Redeveloping Shoreland Property, WD-BB-33, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Lake Eutrophication, WD-BB-3, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Proper Lawn Care Can Protect Waters, WD-BB-31, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

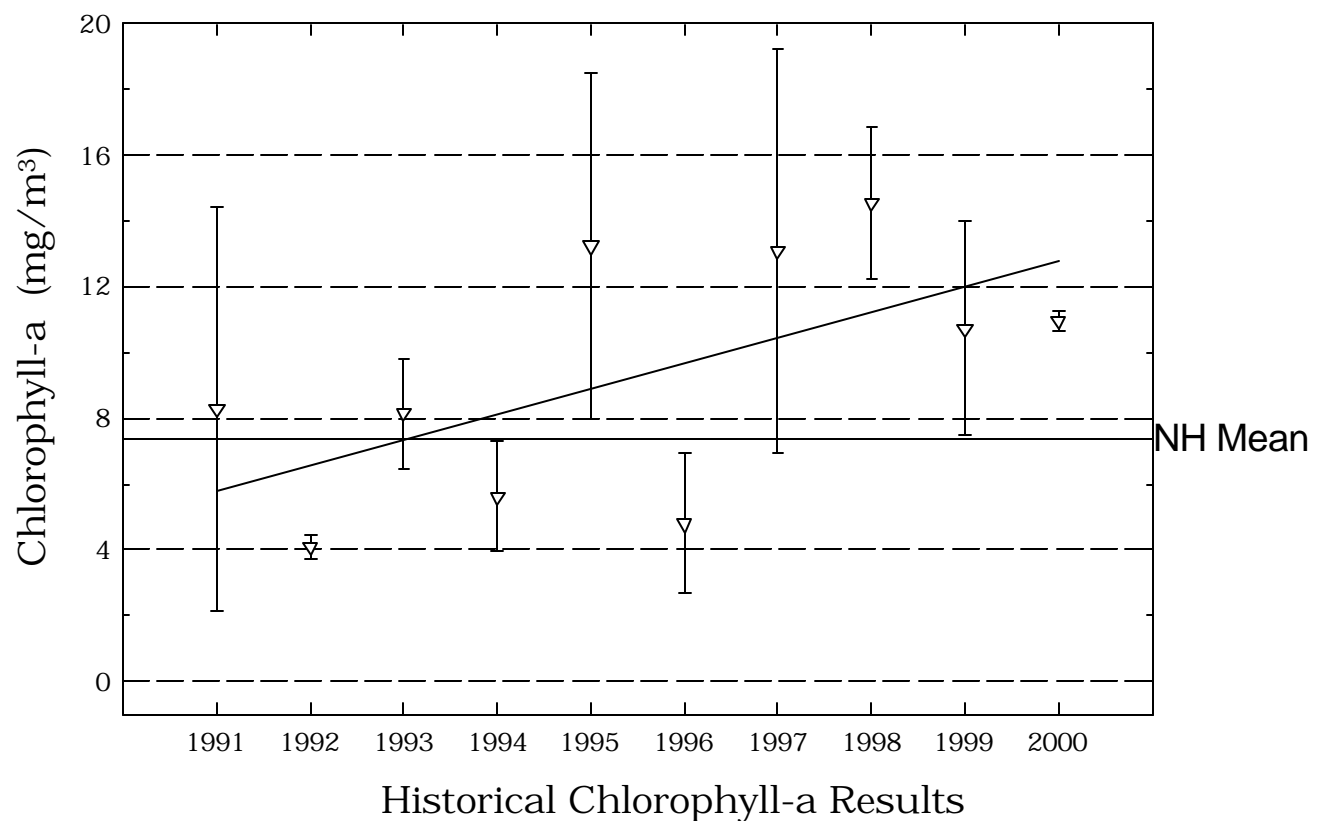
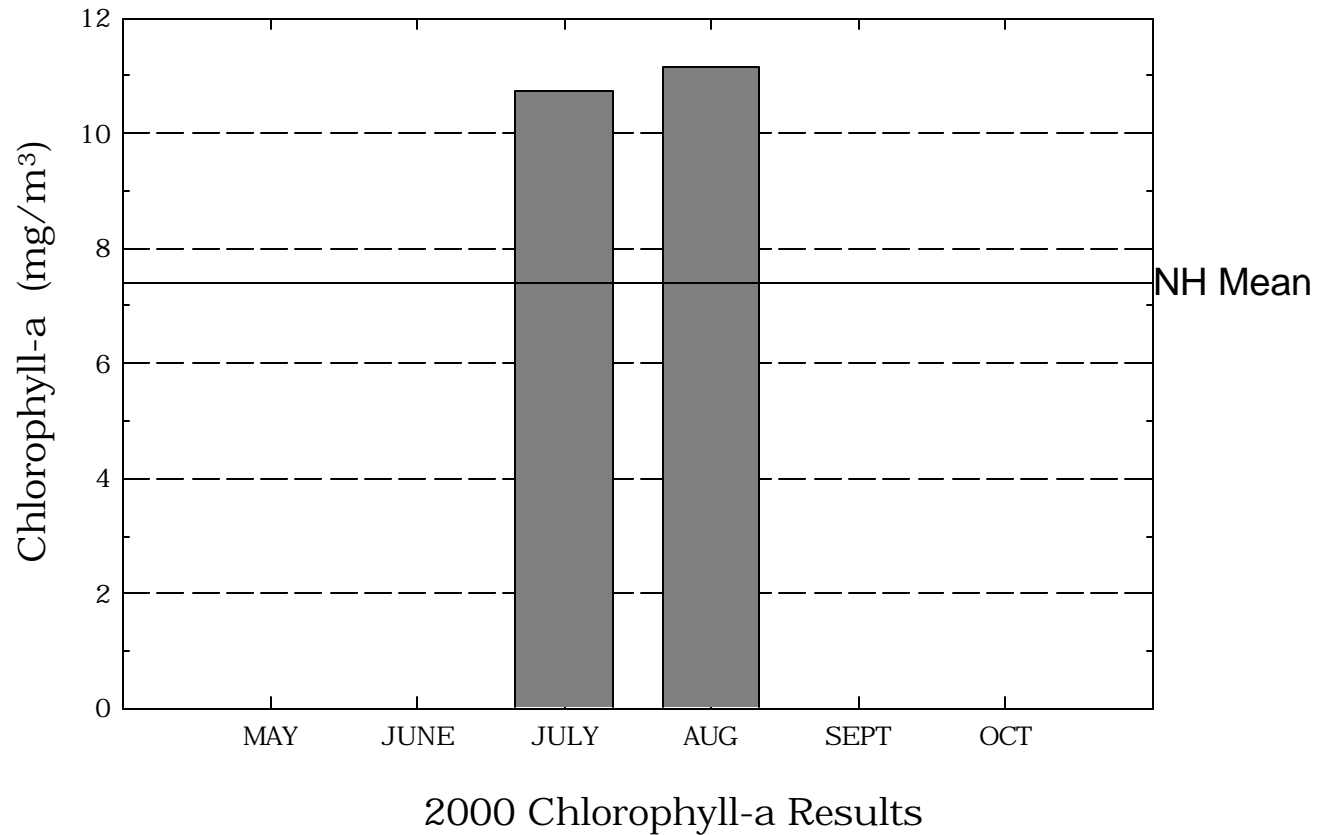
Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

Soil Erosion and Sediment Control on Construction Sites, WD-WEB-12, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

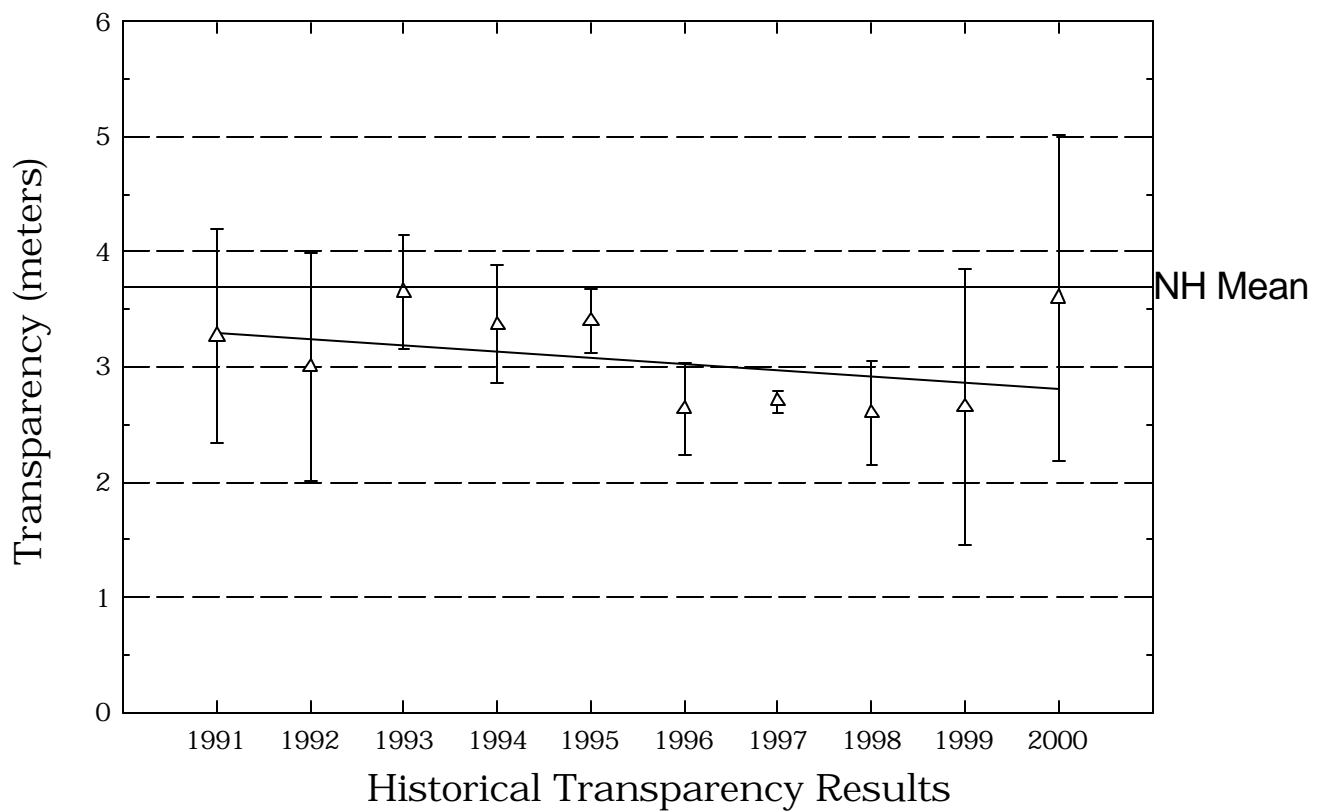
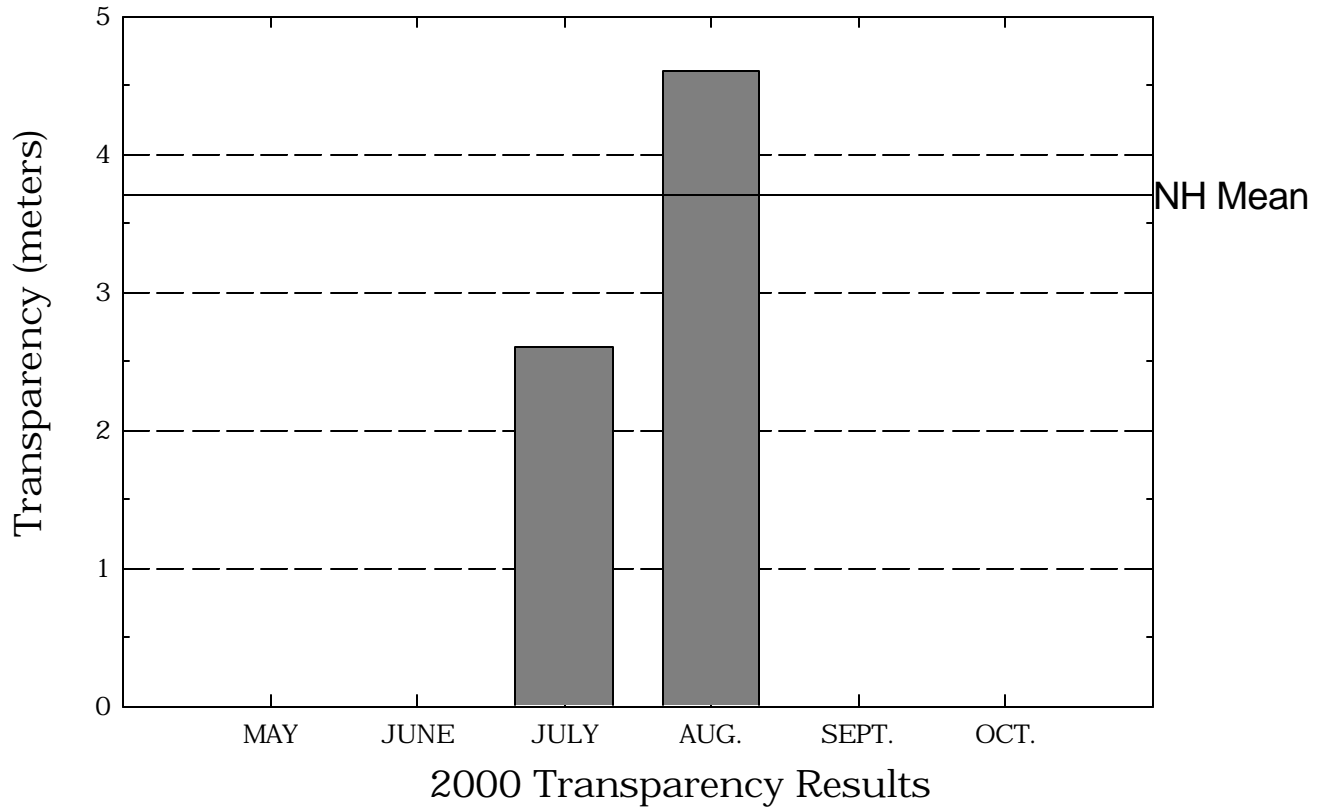
Forest Lake, Winchester

Figure 1. Monthly and Historical Chlorophyll-a Results



Forest Lake, Winchester

Figure 2. Monthly and Historical Transparency Results



Forest Lake, Winchester

Figure 3. Monthly and Historical Total Phosphorus Data.

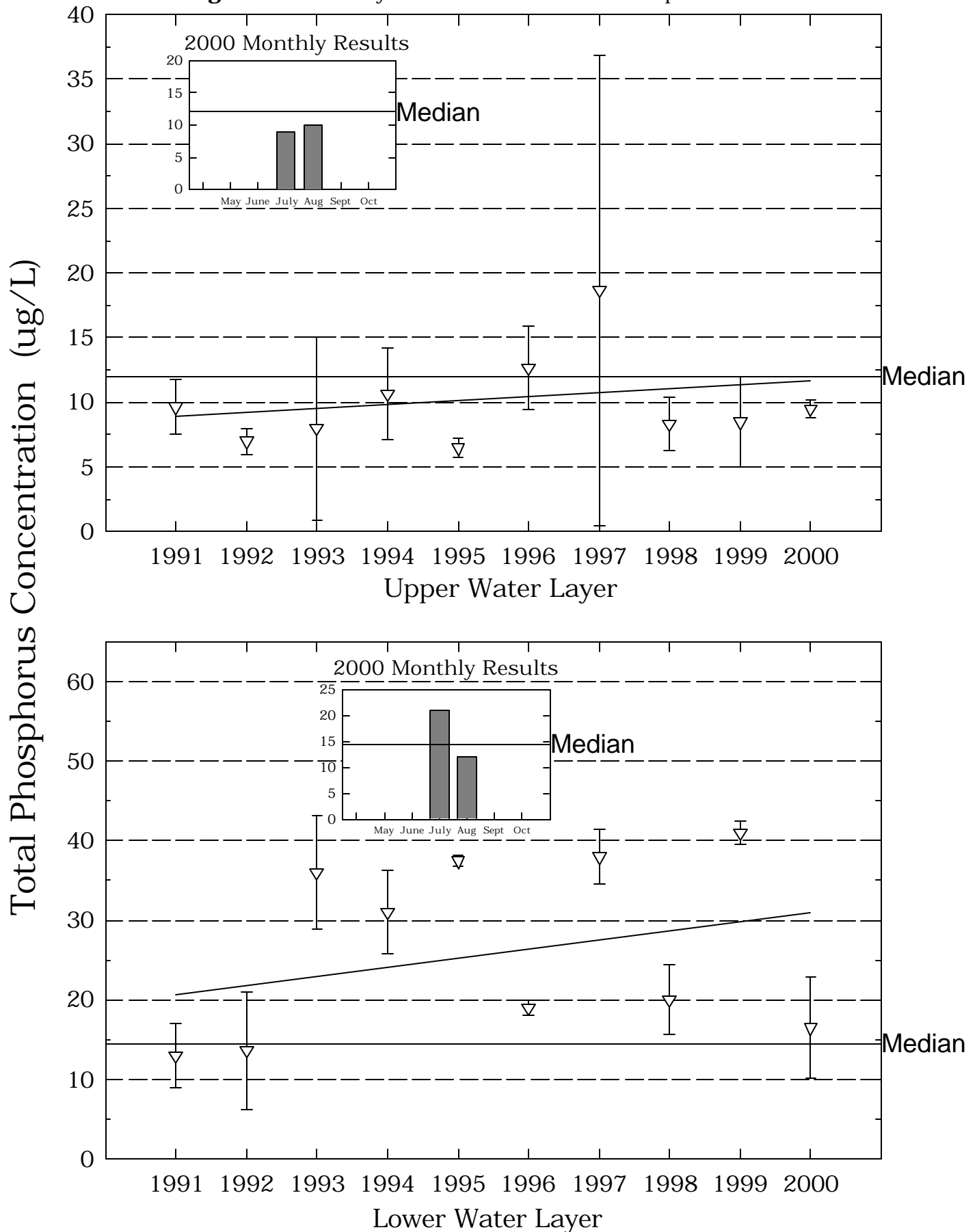


Table 1.**FOREST LAKE
WINCHESTER****Chlorophyll-a results (mg/m³) for current year and historical
sampling periods.**

Year	Minimum	Maximum	Mean
1991	2.70	14.84	8.27
1992	3.65	4.39	4.07
1993	6.95	9.34	8.14
1994	4.12	7.42	5.61
1995	9.53	16.97	13.25
1996	2.94	7.11	4.79
1997	9.51	20.20	13.10
1998	12.28	16.88	14.55
1999	8.44	13.04	10.74
2000	10.75	11.17	10.96

Table 2.

**FOREST LAKE
WINCHESTER**

**Phytoplankton species and relative percent abundance.
Summary for current and historical sampling seasons.**

Date of Sample	Species Observed	Relative % Abundance
06/19/1991	ASTERIONELLA	64
	CERATIUM	15
08/22/1992	DINOBRYON	88
	CHRYSOSPHAERELLA	6
07/12/1993	ASTERIONELLA	52
	CHRYSOSPHAERELLA	24
06/21/1994	SYNURA	72
	DINOBRYON	16
09/21/1994	DINOBRYON	30
	COELOSPHAERIUM	14
	PERIDINIUM	18
06/23/1995	ASTERIONELLA	76
	MELOSIRA	9
	CHRYSOSPHAERELLA	6
06/12/1996	ANABAENA	20
	MELOSIRA	13
	ASTERIONELLA	6
06/24/1997	MELOSIRA	28
	ASTERIONELLA	25
	CERATIUM	22
06/25/1998	CHRYSOSPHAERELLA	49
	DINOBRYON	46
	CERATIUM	3
08/04/1999	DINOBRYON	45
	ASTERIONELLA	19
	RHIZOLENIA	14
08/24/2000	DINOBRYON	62
	SYNURA	14
	CERATIUM	9

Table 3.**FOREST LAKE
WINCHESTER****Summary of current and historical Secchi Disk
transparency results (in meters).**

Year	Minimum	Maximum	Mean
1991	2.5	4.3	3.2
1992	2.3	3.7	3.0
1993	3.3	4.0	3.6
1994	2.8	3.8	3.3
1995	3.2	3.6	3.4
1996	2.2	3.0	2.6
1997	2.6	2.8	2.7
1998	2.2	3.1	2.6
1999	1.8	3.5	2.6
2000	2.6	4.6	3.6

Table 4.

**FOREST LAKE
WINCHESTER**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
CAMPGROUND INLET	1991	5.74	7.00	6.16
	1992	6.61	7.00	6.76
	1993	6.89	6.93	6.91
	1994	6.56	6.72	6.64
	1995	6.66	6.79	6.72
	1996	6.26	6.65	6.40
	1997	6.68	6.74	6.71
	1998	6.52	6.68	6.61
	1999	6.50	6.78	6.62
	2000	6.41	6.43	6.42
DUMP BRANCH	1996	6.82	6.82	6.82
	1997	6.91	7.23	7.08
	1998	6.79	7.00	6.90
	1999	7.01	7.11	7.06
	2000	6.78	6.79	6.78
EPILIMNION	1991	6.57	7.30	6.83
	1992	6.87	7.20	7.04
	1993	7.32	7.34	7.33
	1994	6.97	7.23	7.08
	1995	7.05	7.17	7.11
	1996	6.40	6.65	6.55
	1997	6.86	7.45	7.15

Table 4.

**FOREST LAKE
WINCHESTER**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
	1998	6.73	7.16	6.90
	1999	6.71	6.91	6.80
	2000	6.86	6.96	6.91
HYPOLIMNION				
	1991	6.40	6.60	6.52
	1992	6.38	7.11	6.70
	1993	6.35	6.94	6.55
	1994	6.15	6.66	6.41
	1995	6.30	6.87	6.50
	1996	5.95	6.25	6.06
	1997	6.28	6.51	6.38
	1998	6.18	6.37	6.29
	1999	6.33	6.34	6.33
	2000	6.33	6.46	6.39
METALIMNION				
	1992	6.84	6.84	6.84
	1993	6.37	6.77	6.53
	1994	6.32	6.92	6.46
	1995	6.44	6.76	6.57
	1996	6.06	6.14	6.10
	1997	6.32	6.56	6.41
	1998	5.75	6.12	5.96
	1999	6.41	6.67	6.52
	2000	6.28	6.29	6.28

Table 4.

**FOREST LAKE
WINCHESTER**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
NE BRANCH UPSTREAM	1997	7.05	7.15	7.08
	1998	6.78	6.99	6.90
	1999	6.97	7.38	7.13
NE BRANCH	1996	6.65	6.82	6.73
	1997	7.09	7.31	7.18
	1998	6.75	7.07	6.91
OUTLET	1991	7.00	7.30	7.17
	1992	6.60	7.36	6.93
	1993	6.86	7.29	7.02
	1994	6.83	7.13	6.99
	1995	7.07	7.11	7.09
	1996	6.69	6.95	6.79
	1997	6.91	7.31	7.10
	1998	6.75	6.90	6.81
	1999	6.83	7.15	6.96
	2000	6.86	6.94	6.90
SANDY POINT INLET	1991	6.80	7.00	6.87
	1992	6.81	7.08	6.89
	1993	6.62	6.98	6.76
	1994	6.75	6.87	6.82

Table 4.

**FOREST LAKE
WINCHESTER**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
	1995	6.65	6.99	6.79
	1996	6.33	6.64	6.44
	1997	6.96	7.04	6.99
	1998	6.33	6.86	6.59
	1999	6.70	7.00	6.82
	2000	6.75	6.85	6.80

Table 5.**FOREST LAKE****WINCHESTER****Summary of current and historical Acid Neutralizing Capacity.****Values expressed in mg/L as CaCO₃.****Epilimnetic Values**

Year	Minimum	Maximum	Mean
1991	8.80	10.90	9.57
1992	7.00	9.60	8.50
1993	9.40	9.70	9.55
1994	7.00	12.40	9.97
1995	6.70	9.30	8.00
1996	6.10	10.20	8.70
1997	9.00	9.80	9.53
1998	5.70	8.70	7.63
1999	8.50	10.90	9.70
2000	7.90	8.20	8.05

Table 6.

**FOREST LAKE
WINCHESTER**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
CAMPGROUND INLET	1991	210.0	460.0	316.0
	1992	144.9	248.3	200.7
	1993	265.0	337.0	301.0
	1994	173.8	240.0	200.3
	1995	185.6	247.0	216.3
	1996	86.9	244.0	142.0
	1997	168.8	231.0	193.9
	1998	84.6	264.0	182.4
	1999	91.5	170.1	130.8
	2000	97.0	101.1	99.0
DUMP BRANCH	1996	290.4	290.4	290.4
	1997	382.0	413.3	399.7
	1998	283.1	423.0	364.6
	1999	282.0	340.0	311.0
	2000	224.0	229.0	226.5
EPILIMNION	1991	92.6	109.5	102.1
	1992	79.5	90.1	84.3
	1993	86.6	93.0	89.8
	1994	65.1	91.4	82.0
	1995	72.4	80.0	76.2
	1996	65.9	85.4	74.1
	1997	69.4	78.9	73.3

Table 6.

**FOREST LAKE
WINCHESTER**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1998	47.4	69.2	58.8
	1999	73.1	75.5	74.3
	2000	53.5	58.4	56.0
HYPOLIMNION				
	1991	85.8	89.0	87.5
	1992	77.0	101.7	87.8
	1993	97.2	122.4	109.8
	1994	89.4	126.4	110.6
	1995	75.7	88.7	82.2
	1996	65.8	74.7	68.8
	1997	58.1	78.5	69.8
	1998	76.9	99.3	88.1
	1999	79.8	93.2	86.5
	2000	62.1	66.2	64.2
METALIMNION				
	1992	82.2	82.2	82.2
	1993	68.9	75.8	72.3
	1994	58.5	86.0	72.9
	1995	68.6	74.3	71.4
	1996	59.8	65.6	62.7
	1997	56.5	64.9	60.0
	1998	63.1	73.4	68.5
	1999	74.7	75.7	75.2
	2000	56.7	58.6	57.7

Table 6.**FOREST LAKE
WINCHESTER****Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
NE BRANCH UPSTREAM	1997	59.2	81.8	69.5
	1998	41.7	76.9	62.1
	1999	55.1	74.9	65.0
NE BRANCH	1996	52.1	83.0	67.5
	1997	60.3	79.7	69.5
	1998	42.7	77.5	63.0
OUTLET	1991	93.6	108.4	101.9
	1992	77.3	91.1	84.5
	1993	86.5	92.2	89.3
	1994	66.0	89.5	81.3
	1995	72.4	82.3	77.3
	1996	62.3	80.2	70.9
	1997	66.3	77.8	71.9
	1998	48.6	68.8	59.1
	1999	71.6	75.3	73.4
	2000	53.4	57.6	55.5
SANDY POINT INLET	1991	30.8	36.0	32.9
	1992	28.2	29.8	29.1
	1993	32.4	34.5	33.4
	1994	32.9	34.0	33.3
	1995	30.3	33.6	31.9

Table 6.

**FOREST LAKE
WINCHESTER**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1996	22.6	33.8	27.4
	1997	29.1	30.1	29.4
	1998	23.4	34.4	29.7
	1999	26.7	37.3	32.0
	2000	25.4	27.4	26.4

Table 8.

**FOREST LAKE
WINCHESTER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
CAMPGROUND INLET	1991	19	22	20
	1992	13	21	17
	1993	27	38	32
	1994	17	28	23
	1995	18	52	35
	1996	12	23	17
	1997	22	34	27
	1998	16	19	17
	1999	17	38	27
	2000	10	13	11
DUMP BRANCH	1997	16	22	18
	1998	9	15	11
	1999	10	22	16
	2000	10	12	11
EPILIMNION	1991	8	12	9
	1992	6	8	7
	1993	3	13	8
	1994	7	14	10
	1995	6	7	6
	1996	9	15	12
	1997	4	39	18
	1998	6	10	8

Table 8.

**FOREST LAKE
WINCHESTER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1999	6	11	8
	2000	9	10	9
HYPOLIMNION				
	1991	9	17	13
	1992	8	22	13
	1993	31	41	36
	1994	25	35	31
	1995	37	38	37
	1996	18	20	19
	1997	36	42	38
	1998	15	23	20
	1999	40	42	41
	2000	12	21	16
METALIMNION				
	1992	9	9	9
	1993	17	17	17
	1994	14	18	16
	1995	9	14	11
	1996	7	11	9
	1997	10	20	13
	1998	8	9	8
	1999	9	15	12
	2000	7	10	8
NE BRANCH UPSTREAM				
	1997	13	26	20
	1998	12	20	15

Table 8.

**FOREST LAKE
WINCHESTER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
NE BRANCH	1999	11	23	17
	1996	10	37	23
	1997	19	36	26
OUTLET	1998	10	18	14
	1991	10	11	10
	1992	8	9	8
	1993	9	9	9
	1994	8	30	19
	1995	6	8	7
	1996	7	10	9
	1997	7	15	9
	1998	8	9	8
	1999	8	11	9
	2000	7	7	7
SANDY POINT INLET				
	1991	19	24	21
	1992	13	17	15
	1993	19	38	28
	1994	20	47	32
	1995	25	54	39
	1996	9	17	13
	1997	17	20	18
	1998	0	14	8

Table 8.

**FOREST LAKE
WINCHESTER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1999	10	16	13
	2000	5	8	6

Table 9.
FOREST LAKE
WINCHESTER

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
August 24, 2000			
0.1	22.3	8.5	98.4
1.0	21.0	8.6	96.9
2.0	20.9	8.5	94.9
3.0	20.4	8.5	94.2
4.0	18.0	3.5	37.4
5.0	14.7	1.7	16.8
6.0	12.0	0.3	2.9
7.0	10.3	0.2	1.6
8.0	9.1	0.2	1.7
9.0	8.7	0.2	1.9
9.5	8.6	0.3	2.9

Table 10.**FOREST LAKE
WINCHESTER****Historic Hypolimnetic dissolved oxygen and temperature data.**

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 19, 1991	9.0	6.8	0.2	1.6
August 22, 1992	9.5	8.0	0.1	0.8
July 12, 1993	9.6	8.1	0.1	1.0
June 21, 1994	9.0	5.5	0.5	4.0
September 21, 1994	9.5	6.9	0.4	3.0
June 23, 1995	8.5	7.0	0.6	5.0
June 12, 1996	9.5	6.5	0.4	3.0
June 24, 1997	9.0	7.0	0.4	3.0
June 25, 1998	9.0	7.4	0.1	1.0
August 4, 1999	9.0	8.4	0.6	5.0
August 24, 2000	9.5	8.6	0.3	2.9

Table 11.**FOREST LAKE
WINCHESTER****Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
CAMPGROUND INLET	1997	0.9	1.3	1.1
	1998	0.9	3.6	1.9
	1999	1.5	2.2	1.8
	2000	0.6	0.8	0.7
DUMP BRANCH	1997	2.9	5.8	4.2
	1998	4.2	4.9	4.4
	1999	6.3	10.4	8.3
	2000	6.7	7.0	6.8
EPILIMNION	1997	0.6	0.7	0.6
	1998	0.8	0.9	0.8
	1999	0.6	1.2	0.9
	2000	0.3	0.7	0.5
HYPOLIMNION	1997	19.0	27.0	21.6
	1998	2.0	6.2	4.4
	1999	7.9	26.0	16.9
	2000	2.4	12.7	7.5
METALIMNION	1997	0.6	1.5	1.0
	1998	0.9	1.6	1.1
	1999	0.7	1.3	1.0
	2000	0.4	1.2	0.8
NE BRANCH UPSTREAM				

Table 11.**FOREST LAKE
WINCHESTER****Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
	1997	0.6	0.7	0.6
	1998	0.7	1.3	1.0
	1999	0.7	0.8	0.8
NE BRANCH				
	1997	0.6	0.6	0.6
	1998	1.1	1.3	1.1
OUTLET				
	1997	0.4	0.9	0.6
	1998	0.6	0.8	0.7
	1999	0.6	1.2	0.9
	2000	0.4	0.5	0.5
SANDY POINT INLET				
	1997	0.6	1.6	1.1
	1998	0.6	1.0	0.8
	1999	0.8	0.9	0.9
	2000	0.4	0.5	0.4